DOCUMENT RESUME

ED 338 228 IR 015 266

AUTHOR Stahl, William A.; Johnson, Brian
TITLE Evaluating the Electronic Blackboard: Technical Paper #1.
INSTITUTION Canadian International Development Agency, Ottawa (Ontario).
SPONS AGENCY Regina Univ. (Saskatchewan).; University Grants Commission, New Delhi (India).
PUB DATE 90
NOTE 39p.; Report written for the Canadian International Development Agency project, "A Design Model for a Computerizing University."
PUB TYPE Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Audiovisual Aids; Educational Technology; Electronic Equipment; Foreign Countries; Higher Education; Hypothesis Testing; *Illustrations; *Instructional Effectiveness; Interaction; Intermode Differences; *Lecture Method; *Microcomputers; Questionnaires; Teaching Methods
IDENTIFIERS *Electronic Blackboards; University of Regina SK

ABSTRACT

This study of the effectiveness of electronic blackboards in three introductory sociology classes at the University of Regina tested the hypothesis that this microcomputer-based presentational technology would have a negative impact on faculty productivity due to the increased amount of preparation time, and a positive impact on the quality of learning. Computer-prepared illustrated lectures were presented to two test classes, while a control class received the same material without the illustrations. Evaluation questionnaires using a five-point scale were administered prior to and after the experiment to all three classes. In addition, an in-class observer monitored all three classes, and all three were videotaped for review by a faculty panel. Follow-up interviews were conducted in both test classes. It was found that the electronic blackboard method was not successful because: (1) it took faculty five times longer to prepare an illustrated lecture than a normal one; (2) the electronic presentation interfered with normal patterns of classroom interaction; (3) students were dissatisfied with the electronic blackboard; (4) the electronic blackboard forced students to concentrate on two different sources of information simultaneously, resulting in a negation of any benefits gained by superior organization and visual imagery; and (5) rural and low income students may have been negatively affected. It is concluded that, given the current state of the technology, the electronic blackboard is not effective under the conditions tested. Copies of the study consent form and the pre-experiment, control group, and test group questionnaires are appended. (5 references) (DB)

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED338228

TECHNICAL PAPER #1

EVALUATING THE ELECTRONIC BLACKBOARD

by
William A. Stahl
Brian Johnson

IR015266

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

William A. Stahl

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

This report was prepared as part of the Canadian International Development Agency (CIDA) project "A Design Model for a Computerizing University" being conducted jointly by the University of Regina, Regina, Saskatchewan; Gujarat University, Ahmedabad; and the University Grants Commission of India.

© 1990 The University of Regina

ACKNOWLEDGEMENTS: We would like to thank the following members of the project team for their assistance: Dr. Murry Knuttila of the Department of Sociology; Dr. Brien Maguire of the Computer Science Department; and Dr. Barbara Kaltz of the French Program, Luther College, University of Regina. In addition to the project team, we would like to thank Dr. Barry Anderson of the Department of Sociology for allowing his class to be used as the control group and Mohammed Elhadi, a graduate student in computer science, for providing technical assistance.

William A. Stahl is Assoc. Professor of Sociology at Luther College, University of Regina. Brian Johnson is a graduate student in Social Studies at the University of Regina.

Executive Summary

Evaluating the Electronic Blackboard

Hypothesis

An electronic blackboard is the use of microcomputer-based presentational technology to illustrate lectures. We expected that electronic blackboards would impact negatively on faculty productivity (a slight increase in the quality of teaching would not offset the large amount of time needed for preparation) and positively on the quality of learning.

Procedures

We conducted a controlled experiment involving three introductory sociology classes at the University of Regina in the fall 1989 semester. Computer-prepared illustrated lectures were presented to two test classes, while a control class received the same material without illustrations. Evaluation questionnaires using a five-point scale were administered prior to and after the experiment to all three classes. An in-class observer monitored all three classes, and all were videotaped for review by a faculty panel. Follow-up interviews were conducted in both test classes.

Results

The electronic blackboard was not successful in our experiment. We measured negative impacts on all of our variables.

- Faculty productivity declined sharply. It took five times as long to prepare an illustrated lecture as a normal one.

- Teaching quality declined as the electronic presentation interfered with normal patterns of classroom interaction.

- The students were dissatisfied with the electronic blackboard. The evaluations of both test classes were not significantly different from the control group but were much worse than the pre-experiment classes.

- The electronic blackboard forced students to concentrate on two different sources of information simultaneously. The resulting division of attention and distraction more than negated whatever benefits might have been gained by superior organization and visual imagery.

- Gender was apparently not a major factor.

- There is some (weak) evidence that rural and low income students were negatively affected by the electronic blackboard.

Conclusion

Given the current state of the technology, the electronic blackboard is not effective under the conditions tested. Some forms of computerized teaching may be effective in the university classroom, but we believe that at this time the electronic blackboard is not one of them.

Over the past ten years microcomputers have become ubiquitous in North American universities. Ubiquitous, that is, except in the classroom. While some disciplines make extensive use of computers for teaching purposes, in a variety of ways, others apparently rarely, if ever, use computers in the classroom. At the same time, students' pre-university experiences have been shaped by these new technologies. Many have speculated that rock video, VCRs, video games, and the all-pervasive television are changing the way people perceive the world (cf.: McLuhan, 1964; Meyrowitz, 1985). Bold graphics, special effects, and iconography have become the hallmarks of what some claim is a more visually-oriented world.

Canadian higher education relies extensively upon lecture format classes at the introductory level, especially in the social sciences and humanities. Can the graphics capabilities of microcomputers be used to enhance these classes? If our students are coming to university already oriented to visual images, it would seem that there would be considerable potential for an "electronic blackboard."

Unfortunately, the literature provides few guidelines. While there is a vast literature on the use of microcomputers in teaching, little of it involves evaluation. Much is either of the "golly-gee-whiz, look what I did" variety or is written in the future tense-- more concerned with what computers *could* do than evaluating actual performance (cf.: Danzinger, 1985). In one review of the literature, Jolicoeur and Berger (1986:7) found only 47 outcome evaluation studies and of these only two met the conditions of evaluating an individual software package with an objective test and a control group. Very little is published on electronic blackboards in university teaching.

Will the use of an electronic blackboard improve faculty productivity and the quality of learning? We tested this hypothesis in three introductory sociology classes at the University of Regina during the fall semester of 1989. U of R introductory sociology classes are fairly typical of those across Canada. They are medium to large sized (45 to well over 100 students) lecture format classes using a survey approach. Most of the students are in their first year and relatively few have a declared major in the social sciences. For the majority of students this is a service class used to fulfill university requirements. Two of our project team (Knuttila and Stahl) have a combined total of 36 semesters experience teaching these classes.

We define an electronic blackboard as microcomputer-based presentational technology. In this test we used More II presentational software, augmented by various graphics packages, on a Macintosh IIcx to generate colour illustrated lectures which were then displayed on a large screen.

Our dependent variables were faculty productivity and quality of learning. We defined an increase in faculty productivity as an increase in uncommitted faculty time (which, *ceteris paribus*, should lead to increased research, publications, etc.) and in the quality of teaching. The quality of teaching is more subjective but can be judged by peer review. An increase in the quality of learning is defined as improved student satisfaction and performance.

We expected that electronic blackboards would impact negatively on faculty productivity (a slight increase in the quality of teaching would not offset the large amount of time needed for preparation) and positively on the quality of learning. Whether this would result in a net gain or loss would be a judgment dependent upon our results.

PROCEDURES

If the electronic blackboard "works" it should enhance those situations which students find most boring and which faculty find most difficult to teach. In our experience,

the three most difficult areas in an introductory sociology class are history, statistics, and theory. Consequently, we prepared three illustrated lectures: an historical profile of religion in Canada, a statistical profile of religion in Canada, and secularisation theory. The lectures were then given to three sections of Sociology 100 over a one week period. The two test classes saw the illustrations on a large screen while the control group had the same lectures without the electronic blackboard (an overhead projector was used for several maps and graphs in the control group). Initially, a second round of lectures was planned for one class which would have divided the group into control and test subsections in order to measure student performance. Unfortunately, excessive preparation time (see below) forced the cancellation of this portion of the experiment.

We used multiple measures for each of the variables. For faculty productivity we measured faculty time and the quality of teaching. In order to obtain a real test of preparation time we had to include the learning curve for both hardware and software. Therefore, one of us (Stahl), who was moderately experienced on microcomputers but was new to both the Macintosh and computer graphics, prepared all the lectures, keeping a log of his time. The first two lectures were somewhat "off the shelf" and only needed revision and the addition of illustrations. The third was prepared "from scratch," and he held back from working on it until he was confident in his use of the machine and software. We thus obtained a measure of both the learning curve and of preparation time for a somewhat experienced user.

The quality of teaching is inherently a more subjective evaluation. Peer review, however, should give as accurate a measure of teaching as it does for proposals or publications. An in-class observer (Johnson) monitored all three classes prior to and during the experiment. One of the pre-experiment classes (Knuttila's day class) was videotaped on two occasions and all the control and test lectures were videotaped. A panel of faculty later reviewed the tapes for evaluation.

The chief indicator of the quality of learning was student satisfaction. Because the second round of the experiment had to be cancelled, we had no controlled means of obtaining data on student performance. Student satisfaction was measured through questionnaires and interviews. Questionnaires (see appendix B) were administered to all three classes several weeks prior to the experiment and again at its conclusion. The instrument recorded socio-economic and academic data, used a five-point attitudinal scale, and included several essay-type questions for additional opinion. The questionnaires for the two test classes differed slightly in the wording of several questions (to make them relevant to the presentation) and in having one additional question (which did not apply to the non-test situations) but were fully comparable. Following the experiment, Johnson interviewed five students from each test class. Each interview lasted between 30 and 45 minutes and was recorded and transcribed under a pseudonym.

DIFFICULTIES

In the course of the experiment we encountered several practical and theoretical difficulties. The first was software. Because it is oriented so much towards business, the computer industry has not often taken the particular needs of the university into account. A business person can devote time and resources to a presentation because usually it will be used many times. A university professor needs many presentations each of which may be used once. While More II was not a particularly difficult program to learn and use, we wanted more than simple bullet charts so additional graphics had to be imported. This required both learning several graphics packages and purchasing collections of electronic "clip art." Since the paint and draw programs we had did not produce charts and graphs, a graphing program was also needed. Each additional software package multiplied the cost as well as the learning and preparation time. Clip art packages are available in a variety of formats, but most are heavily oriented to business. Little is available which is usable in an historical or sociological presentation. In order to obtain enough illustrations we had to

locate pictures, capture them on a scanner, and then edit them in a graphics program. Once again, learning and preparation time multiplied.

Displaying the lectures on a large screen proved surprisingly difficult. A single monitor is too small to be seen by a large class. A "smart classroom" containing a number of networked monitors was not available to us at the University of Regina. LCD projector pallets which utilize an overhead projector do not use colour. We finally settled on an RGB projector and a large-screen TV, both of which required the use of an NCC converter. This seriously degraded the quality of the picture. Since we had to use the converter anyway, we videotaped the presentations and showed them using a four-head VCR with stop-frame control.

Co-operation and co-ordination also proved difficult. Dr. Barry Anderson, whose morning class served as our control group, gave us splendid co-operation. Unfortunately, the University of Regina Audio-Visual Services did not. Their denial of equipment caused delays and forced us to move both test classes out of their usual classrooms into much less satisfactory venues. Even with full co-operation between Drs. Anderson, Knuttila, and Stahl, co-ordination was difficult. It proved impossible to "fit" the presentations smoothly into the flow of the classes. Consequently, the control and test sessions were intrusive episodes. The use of a guest lecturer for the presentations added the complicating factors of differences in personality and teaching style.

In addition to these practical difficulties, there were several theoretical problems which we anticipated and attempted to control. First of these was the selectivity problem. As Lieberson reminds us:

> A key feature of the experimental approach is that the subjects . . . are randomly assigned to the conditions under study. If the assignment process is not random, then the investigator must be fully satisfied that it has no bearing on the likely outcome (1985:14).

This affects the validity of the study-- does it measure what it intended to measure? In our case, each class is unique and not fully comparable. The size of the class, the time of day it

meets, the configuration of the classroom, the age, sex, experience, and motivation of the students are all factors which could affect the outcome but which could not be controlled. However, by collecting background socio-economic and academic data and by using multiple measures in pre, control, and test situations we tried to detect the significant factors affecting the outcome.

Reactivity is also a problem. Our subjects were aware of the study and perhaps behaved differently because of it. For ethical reasons, the students were informed of the experiment early in each course and given a consent form (see appendix A). The guest lecturer, videocamera, presentational technology (and in the case of both test classes, moving to a different classroom) were intrusive. Several of our methods mitigated this problem. The in-class observer (Johnson) is a graduate student who easily and unobtrusively "fits in." Questionnaires were anonymous. All the interviews were conducted by Johnson, recorded under a pseudonym, and the interviewees were both given an honorarium and assured that neither their class teacher nor the guest lecturer would be able to identify them. The students of all three classes were co-operative and gave frank evaluations ("God help India" one student in a test class wrote). We expected that many would react to the novelty of the situation, rating the presentations higher simply because they were different. Instead, the written comments lead us to believe that a number of students responded negatively to changes in their usual routine.

RESULTS

The results were not what we had expected. Instead of a slight net loss in faculty productivity and a gain in the quality of learning, we measured negative impacts on all variables.

Learning and preparation time were ***far*** greater than we had anticipated. The combined learning and preparation time for the first two lectures (which were developed simultaneously) totalled 63.25 hours. These were revisions of existing lectures, so none

of this time represents research or planning. Figure I breaks the time down by software package. 'Scanner' represents time locating art and editing the captured images as well as using the scanner itself. 'Video' represents production time recording the presentations on videotape. 'Miscellaneous' is time spent using several programs simultaneously, usually transfering illustrations from graphics packages to More II. The relative time spent on each of these is shown in Figure II. The effects of having to learn and use multiple software packages, scanners, and clip art is readily apparent.

FIGURE I

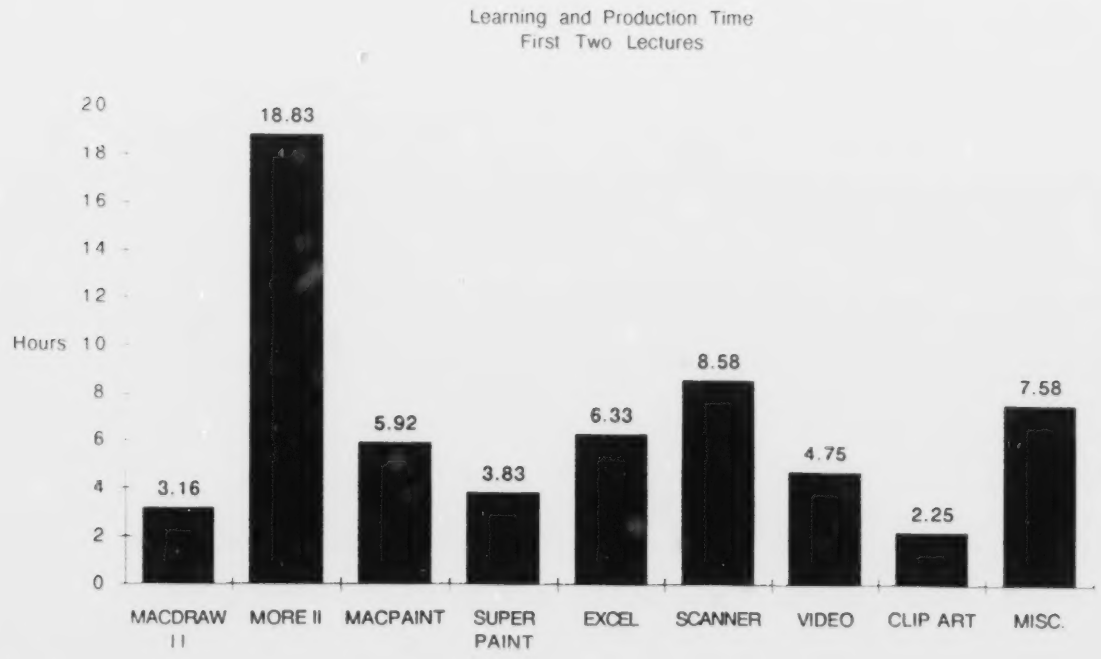


FIGURE II

Learning and Production Time
First Two Lectures

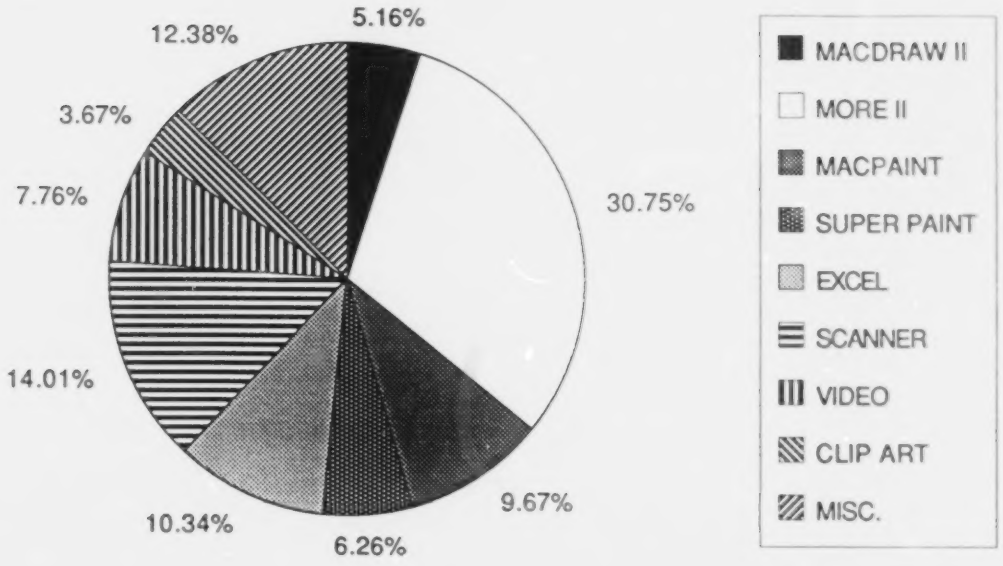
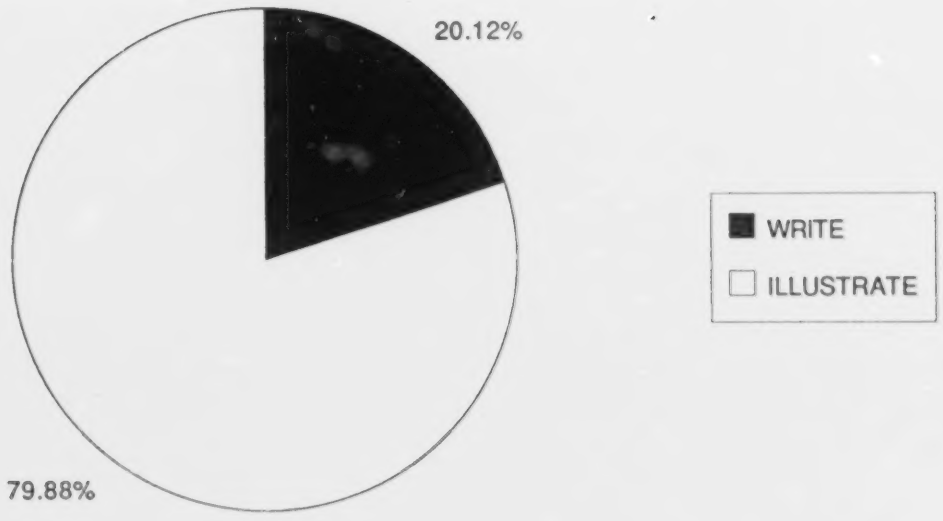


FIGURE III

Preparation Time
Third Lecture



With experience, preparation time declined dramatically but was still excessive. The third lecture, on secularisation theory, was new material although all the research was complete. It took four hours five minutes to plan and write the lecture. At this point it could have been presented normally. It took an additional 16.2 hours to illustrate the lecture, for a total of 20 hours 17 minutes (see Figure III). Thus for a moderately experienced user with research complete and all materials at hand, it took five times as long to prepare an illustrated lecture as the same material presented normally.

In spite of the lengthy preparation time, Stahl and the faculty review panel (Drs. Brien Maguire and Barbara Kaltz) agreed that the quality of teaching suffered. There were several reasons for this. Coming in as a guest lecturer, Stahl felt he had little rapport with the students, yet his presence for a week was long enough to eliminate any novelty to the situation. This was confirmed by several students' comments, complaining of having to adjust to a different teacher's style. The lighting was not good for either test. Both classrooms had to be darkened to see the screen, and in the day class the lecturer was silhouetted by back-lighting. This impeded both faculty and students from establishing eye-contact. The use of illustrations focused the concentration of both student *and* lecturer on the screen, splitting the attention of the class. This became quite obvious in one of the videotapes as students' heads can be seen jerking up from their notes, to the professor, across to the screen, then back to their notes in a mechanical fashion. The normal classroom patterns of interaction were interrupted. Indeed, the entire electronic blackboard format proved to be non-interactive. As one student put it, "It was like watching a movie." If the illustrations did not carry the presentation, there was not enough human interaction to make up the difference. This had repercussions on the control class as well. Since the control class had the same lectures, sans illustrations, the rigid format similarly limited interaction, resulting in a dull presentation.

Our biggest surprise was the strongly negative response from the students. In almost every category they expressed dissatisfaction with the electronic blackboard.

Table 1 shows the mean evaluation scores. Each column identifies the class, whether it was a pre, control, or test group, the date the evaluation was done (in Anderson's morning class evaluation was done in seminars which were spread over several days) and an identification code assigned to each class. Keywords identify each of the evaluative questions. Those marked (-) are worded so that a low number on the five-point scale indicates a favourable response.

TABLE 1

MEAN EVALUATION SCORES

	Morning	Morning	Night	Night	Day	Day
	Pre	Control	Pre	Test	Pre	Test
	11-13 Oct	20-25 Oct	16-Oct	23-Oct	13-Oct	3-Nov
KEYWORDS	class 01	class 04	class 02	class 05	class 03	class 06
10 organize	3.89	3.54	3.91	3.95	4.16	3.95
11 compport	3.62	2.54	3.51	2.85	3.71	2.35
12 effectiv	3.85	2.52	3.76	2.97	4.08	2.48
13 appropri	3.89	3.18	3.89	3.48	4.26	3.36
14 compclas	3.92	2.45	4.04	2.90	4.36	2.58
15 pace	3.46	2.63	3.29	2.72	3.55	2.51
speed	2.00	1.45	1.33	1.50	1.40	1.77
16 quality	3.80	2.86	3.93	3.03	4.00	2.65
17 instruct	4.18	3.00	4.42	3.68	4.58	3.10
18 boring(-)	1.94	3.58	2.02	3.10	1.94	3.20
19 see (-)	2.00	2.80	1.91	3.46	1.72	3.38
20 notes	3.26	2.40	3.02	2.90	3.64	2.98
21 difficul (-)	1.94	1.96	2.06	2.18	1.84	1.92
22 interup(-)	2.90	2.75	2.62	2.77	2.78	2.98
23 understa	3.78	3.01	3.81	2.69	4.06	2.60
24 remember	3.59	2.76	3.71	2.69	3.94	2.63
25 more	3.61	2.59	3.63	2.77	3.76	2.50
26 distract(-)				3.13		3.40
	n=52	n=76	n=53	n=40	n=50	n=40

In order to set up a rigourous test, we had chosen the topics of the lectures because it was material which students usually found boring and faculty found difficult to teach. As the scores for the control group indicate, we succeeded. Control equalled pre on only two questions; numbers 21 ("This material is too difficult") and 22 ("During the presentation, I am afraid to interrupt with a question"). Students overwhelmingly found it more boring. Overall, the control group averaged .85 worse than the pre group on the five-point scale. Several reasons can account for this. In part, the control class suffered by comparison. Dr. Anderson is a popular, effective teacher who had just completed a unit on socialization, a topic which, in our experience, is very popular with introductory students. In part the format of the lectures-- required for comparability with the test classes-- forced the lecturer into a style which restricted interaction. The lectures were a "show down front" but without much of a show. But as the students' commented repeatedly, most of all it was the content of the lectures themselves which they did not like.

The use of the electronic blackboard did nothing to improve students' satisfaction. The test classes equalled the pre scores on only three questions, numbers 10 ("The organization of the presentation was:") and questions 21 and 22 where the control group also did well. Overall, the night class test averaged .70 less favourable and the day class test a massive 1.10 less favourable than their respective pre-experiment classes. Neither test class was significantly different from the control group: the night class averaged .17 better than control and the day class .01 worse. (The day test class also averaged .19 less favourable than the night class.)

A look at the individual questions reveals some patterns. The place where the electronic blackboard was most successful was its ability to make a clearly organized presentation. The bullet charts laid out the lectures in a clear, easy-to-follow manner. A number of students expressed opinions similar to those of "Bob" from the night class:

> Again just the organization of it [made the presentation good]. It was nice to have definite subject headings. I have always had a problem with that. We didn't learn a lot about that in high school. We didn't even take notes on our own in high school

grade 12, so I always had difficulty in just organizing my subject headings and knowing what was relevant and that kind of helped.

As Table 2 shows, on question 10 ("The organization of the presentation was:") the test classes outscored all others in the "excellent" category. It is the *only* question on which the electronic blackboard did so. The test classes were significantly superior to the control group on question 10, but were not significantly different from the pre-tests.

TABLE 2

FREQUENCY DISTRIBUTION PERCENTAGES

10. The organization of this presentation was:
20. The presentation helped me to take notes better:
26. I find the computerized presentation distracting:

CLASS	POOR	FAIR	AVERAGE	GOOD	EXCELLENT
10 ORGANIZE					
01 pre	0	0	25	61.5	13.5
02 pre	0	1.9	22.6	58.5	17
03 pre	0	0	6	72	22
04 control	0	10.5	34.2	46.1	9.2
05 test	0	7.5	12.5	57.5	22.5
06 test	0	12.5	2.5	62.5	22.5
	ST DISAGREE	DISAGREE	UNDECIDED	AGREE	ST. AGREE
20. NOTES					
01 pre	3.8	13.5	46.2	23.1	11.5
02 pre	7.5	22.6	34	24.5	7.5
03 pre	0	12	38	24	26
04 control	14.5	39.5	36.8	6.6	1.3
05 test	20	22.5	12.5	32.5	10
06 test	17.5	20	17.5	37.5	7.5
26. DISTRACT (-)					
05 test	10	27.5	20	20	20
06 test	7.5	25	12.5	30	25

The reasons for this appear when we look at questions 20 ("The presentation helped me to take notes better") and 26 ("I find the computerized presentation distracting"). The test classes were significantly superior to the control class on question 20 but inferior to the pre-experiments (although not significantly so in the night class). Organization helped some students take better notes, but organization alone is not the decisive factor. As "Betty" from the day class explained:

> Well it depends, if you get a prof that just stands there and talks and he doesn't write anything on the board, it's a lot better because, you know, you can see on the screen and it helps you write better notes. But, if some profs write on the board all the time and they explain as they are going, I find it a lot better than using the screen.

She adds: "Because he's talking away and you're reading what's on the screen and I just missed half of what he said." This divided attention was a recurring theme in the interviews. The electronic blackboard forced students to concentrate on two sources of information at once. For some students this was not a problem, but for large numbers it was a disaster (see Table 2; Figure IV). It is also a problem inherent in the electronic blackboard. As "Chuck" from the night class explained; "Well, it was just one other element that you had to contend with as opposed to the listening and looking at the chalkboard." "Al" from the day class described the effect:

> Well, you are always watching the screen because you are afraid to miss a change or something. Because the change wasn't quite obvious and there was no sounds and you would have to watch for the changes so it kept your attention. Its not like where you are writing on a chalkboard you know you can hear the prof writing on the chalkboard and there is some other action involved. So you have to keep alert to make sure what is going on.

The students' divided attention detracted from their ability to take notes and largely negated whatever benefits were gained by clear organization.

This same problem appears in questions 23 ("The computerized presentation helped me to better understand the material") and 24 ("The computerized presentation helped me to better remember the material). Both questions are theoretically important. If, as some have speculated, students today are more visually oriented the electronic blackboard should be

FIGURE IV

FREQUENCY PERCENTAGES

26. I find the computerized presentation distracting:

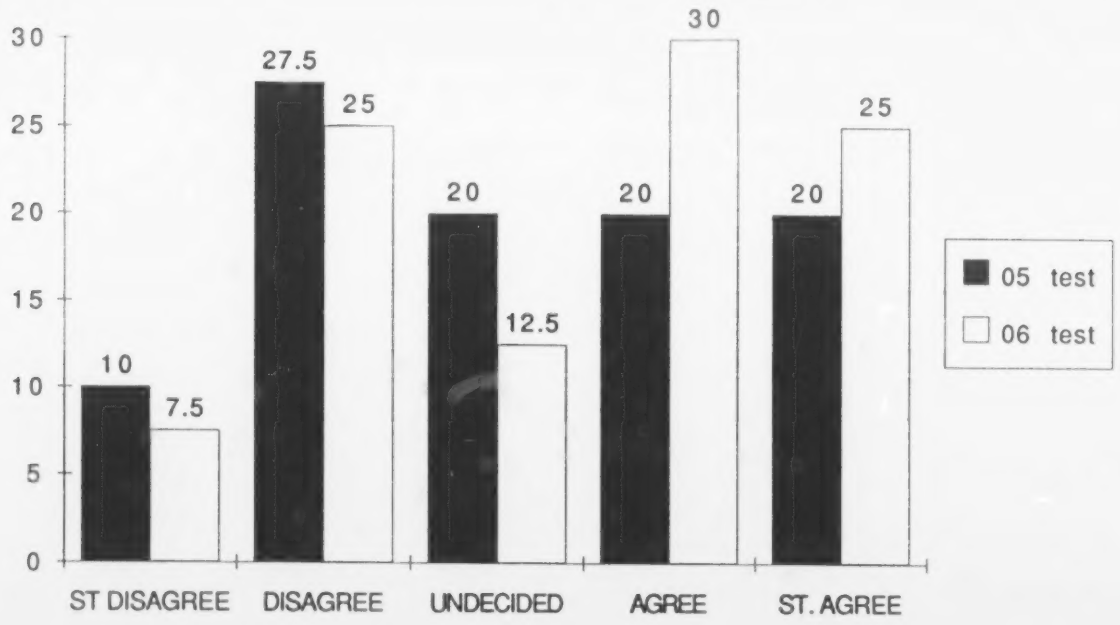


TABLE 3

FREQUENCY DISTRIBUTION PERCENTAGES

23. The computerized presentation helped me to better understand the material:
24. The computcrized presentation helped me to better remember the material:

	ST DISAGREE	DISAGREE	UNDECIDED	AGREE	ST. AGREE
23 UNDERSTA					
01 pre	1.9	3.8	21.2	55.8	13.5
02 pre	0	9.4	15.1	58.5	15.1
03 pre	0	4	10	62	24
04 control	5.3	25	34.2	34.2	1.3
05 test	15	25	35	20	2.5
06 test	17.5	22.5	42.5	17.5	0
24. REMEMBER					
01 pre	1.9	9.6	25	51.9	9.6
02 pre	0	9.4	20.8	54.7	11.3
03 pre	2	2	18	56	22
04 control	6.6	38.2	28.9	25	1.3
05 test	15	25	32.5	25	0
06 test	20	22.5	37.5	15	5

particularly effective in helping students understand and remember the material. It was not. On both questions the test groups were worse than the control (although not significantly so on question 24) and much worse than the pre-experiment classes (see Table 1). Table 3 shows, in particular, the much greater frequency with which people in the test classes strongly disagreed with these two questions. This means either that the theory is incorrect or that the electronic blackboard was unable to capitalize on students' visual orientation. Our evidence points to the second conclusion. Some students did express a visual orientation. "Debbie" commented, "Then again pictures are worth a thousand words and you remember those things in times of exams" while "Betty" added, "I think because when you are thinking of some of the key points you think, what was on the screen at the time and it helps you remember back to what they were talking about." Yet they and most others found the electronic blackboard actually interfered with understanding and remembering the material. "Elsie" was typical of most. When asked why she thought the electronic blackboard made things worse than a normal lecture, she responded: "I think so because you tended to concentrate, actually, on the graphics and not listen to what the professor was saying." As was the case with note-taking, distraction and divided attention negated whatever benefits the visual images of the electronic blackboard might have had.

Two other questions show strong differences between the control and test classes. The chief complaint against the experiment was that it was boring (question 18: "The presentation was boring."). That was the overwhelming opinion of students in the control group (see Table 4). Students in the test classes also found the material boring, although significantly less so than the control group. "Cindy" summed up the feeling of most students: "I am not all that interested ... in this particular topic, no matter how it probably was presented." The control class proved that illustrated lectures without illustrations are tedious. The test classes proved pictures alone are not enough to enliven unpopular material. From the interviewees' responses, it seems that interest was the chief factor in the answers to questions 11, 12, 13, 14 and 16 measuring effectiveness, appropriateness,

TABLE 4
FREQUENCY DISTRIBUTION PERCENTAGES

18. The presentation was boring:
19. The presentation was hard to see:

	ST DISAGREE	DISAGREE	UNDECIDED	AGREE	ST. AGREE
18. BORING (-)					
01 pre	15.4	75	5.8	1.9	1.9
02 pre	22.6	60.4	11.3	3.8	1.9
03 pre	30	54	8	8	0
04 control	0	19.7	18.4	46.1	15.8
05 test	5	32.5	22.5	22.5	15
06 test	2.5	42.5	7.5	27.5	20
19. SEE (-)					
01 pre	25	55.8	11.5	3.8	1.9
02 pre	37.7	43.4	11.3	5.7	1.9
03 pre	40	52	6	0	2
04 control	10.5	42.1	13.2	25	9.2
05 test	7.5	25	5	35	25
06 test	2.5	37.5	7.5	25	27.5

quality, and making comparisons. As one student in the morning class wrote: "I want to be entertained."

Question 19 ("The presentation was hard to see.") is the other place where major differences appear between the control and test groups. Some students had trouble seeing the overhead slides used for graphs in the control group, but as Table 4 shows, *many* students had real trouble seeing the electronic blackboard. The night class saw the presentation through an RGB projector of admittedly mediocre quality. The large screen TV used for the day class had much better resolution but not enough to satisfy students. Since it has been our experience that weaker students tend to sit towards the back of the classroom, the difficulties people farther away from the screen had in seeing would tend to negate the benefits which these students might have gained from the clearer organization of the material on the electronic blackboard.

One difficulty in interpreting these results is created by the selectivity problem. To what extent are these classes fully comparable? On the pre-experiment evaluations, Knuttila's day class consistently gave higher scores than his night class (excepting only question 22, "I am afraid to interrupt."), although both classes received the same material in the same format (see Table 1). During the test, the day class was consistently less favourable than the night class. (The night class gave higher scores on only 3 of 17 questions). There was also a fair amount of bimodalism in the response curves. The day class was bimodal on 8 of 17 questions (#s 10, 12, 13, 18, 19, 20, 25 & 26); the night class on 3 questions (#s 19, 20 & 22); and the control group on 2 of 16 questions (#s 18 & 19). While the day class was the most negative, it also was a group with divided opinions. Obviously, uncontrolled factors, such as the time of day, configuration of the classroom, age and maturity of the students, etc., account for some of the variance.

To better analyze these factors, we created profiles of students who were particularly favourable or unfavourable to the electronic blackboard. We defined a student as favourable who answered 4 or 5 (accounting, of course, for those questions where the scale is inverted) on nine to eleven of seventeen questions and very favourable if on twelve or more. Unfavourable and very unfavourable were defined as answering 1 or 2 on questions in the same proportion. The differences between the two classes stand out (see Figure V). The night class had more students in the neutral category while in the day class those who were very unfavourable were three times as numerous. Unfortunately, determining what caused these differences proved elusive. The socio-economic and academic data we collected established few patterns.

Surprisingly, gender did not appear to be a major factor (see Table 5). In the night class males averaged .05 less favourable than women, but in the day class the men averaged .17 more favourable (although four of the nine very unfavourable students in the day class were men, at 44.4% considerably greater than their proportion in the class). On some of the questions, strong differences between men and women in one class were

FIGURE V

STUDENT PROFILE

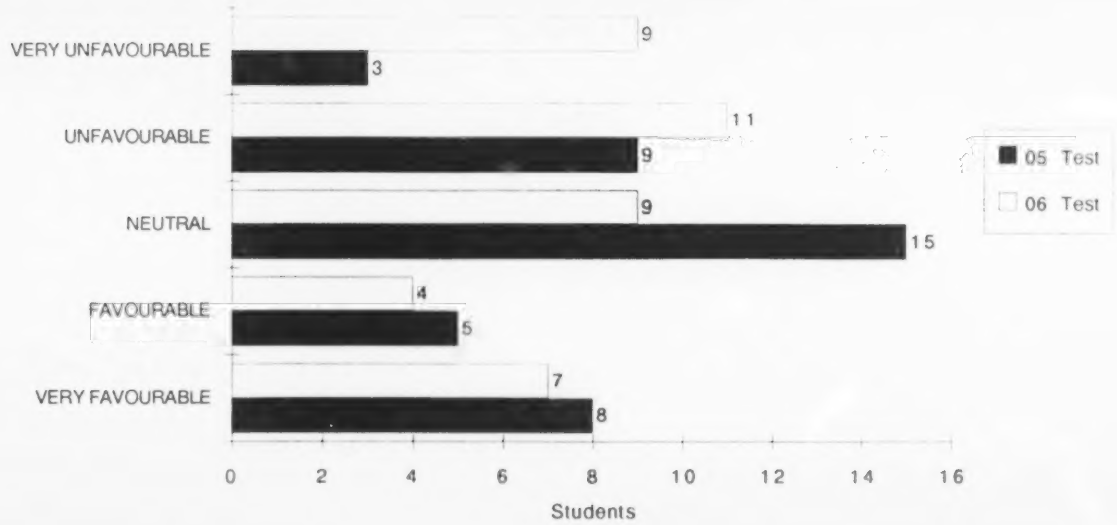


TABLE 5

CONTENT VARIABLES BY SEX

MEAN EVALUATION SCORES

KEYWORDS	05 test total	05 test female	05 test male	06 test total	06 test female	06 test male
10. organize	3.95	4.00	3.83	3.95	4.03	3.73
11. compport	2.84	2.76	3.00	2.35	2.41	2.18
12. effectiv	3.00	2.84	3.33	2.48	2.45	2.55
13. appropri	3.47	3.50	3.42	3.36	3.57	2.82
14. compclas	2.92	2.85	3.08	2.58	2.48	2.82
15. pace	2.78	2.80	2.75	2.51	2.39	2.82
16. quality	3.03	3.04	3.00	2.65	2.66	2.64
17. instruct	3.66	3.81	3.33	3.10	3.21	2.82
18. boring (-)	3.14	3.15	3.09	3.20	3.03	3.64
19. see (-)	3.49	3.65	3.09	3.38	3.28	3.64
20. notes	2.95	2.88	3.09	2.98	3.10	2.64
21. difficul (-)	2.19	2.08	2.45	1.92	2.00	1.70
22. interup (-)	2.76	2.54	3.27	2.98	2.97	3.00
23. understa	2.73	2.62	3.00	2.60	2.62	2.55
24. remember	2.73	2.62	3.00	2.63	2.62	2.64
25. more	2.81	2.73	3.00	2.50	2.55	2.36
26. distract (-)	3.08	3.08	3.09	3.40	3.41	3.36

cancelled by results from the other. The only consistent pattern seems to be that women rated the instructor more highly (question 17).

Other socio-economic categories were similarly unenlightening. Only one person whose first language was not English fell into either profile. As Table 6 shows, there is little difference between the profiles in terms of their age, the number of classes taken before this semester, or their cumulative grade point average.

TABLE 6

STUDENT PROFILE
MEAN OF SELECTED SOCIAL VARIABLES

	VERY FAVOURABLE (12+ OF 17)			FAVOURABLE (9-11 OF 17)			TOTAL
	05 TEST	06 TEST	COMBINED	05 TEST	06 TEST	COMBINED	COMBINED
BIRTH	62.20	69.86	66.03	65.80	67.75	66.78	66.40
CLASSES	3.50	3.71	3.61	2.80	2.25	2.53	3.07
GRADES	2.71	2.67	2.69	3.00	2.33	2.67	2.68
RESIDE	1.50	1.71	1.61	2.00	2.75	2.38	1.99
INCOME	4.25	4.67	4.46	4.40	3.50	3.95	4.20
	n=8	n=7		n=5	n=4		n=24
	VERY UNFAVOURABLE (12+ OF 17)			UNFAVOURABLE (9-11 OF 17)			TOTAL
	05 TEST	06 TEST	COMBINED	05 TEST	06 TEST	COMBINED	COMBINED
BIRTH	64.50	67.22	65.86	63.00	67.89	65.44	65.65
CLASSES	3.33	2.78	3.06	3.22	2.91	3.07	3.06
GRADES	3.00	2.67	2.83	3.00	2.50	2.75	2.79
RESIDE	3.67	1.44	2.56	2.11	1.91	2.01	2.28
INCOME	2.00	5.00	3.50	4.13	3.50	3.81	3.66
	n=3	n=9		n=9	n=11		n=32

On the other hand, Table 6 does appear to show some association with residence and income. Table 7 clarifies these associations. In terms of residence, urban students appear to be somewhat more favourable than rural students. Most of the variance comes from students from small cities who were favourable and those from farms who were not. In the case of income, it appears that students whose families' incomes are under $25,000

TABLE 7

STUDENT PROFILE

FREQUENCY DISTRIBUTION BY RESIDENCE AND INCOME

	VERY FAVOURABLE (12+ OF 17)				FAVOURABLE (9-11 OF 17)				COMBINED	
	05 TEST		06 TEST		05 TEST		06 TEST		TOTALS	
RESIDENCE	#	%	#	%	#	%	#	%	#	%
large city	6	75	4	57.1	2	40			12	50%
small city	1	12.5	1	14.3	1	20	2	50	5	21%
town			2	28.6	2	40	1	25	5	21%
farm	1	12.5					1	25	2	8%
reserve									0	0%
INCOME										
under 14,999									0	0%
15 to 24,999	1	12.5							1	4%
25 to 34,999	2	25	1	14.3	1	20	3	75	7	30%
35 to 44,999	1	12.5	2	28.6	2	40			5	22%
45 to 54,999	2	25	1	14.3	1	20	1	25	5	22%
over 55	2	25	2	28.6	1	20			5	22%

	VERY UNFAVOURABLE (12+ OF 17)				UNFAVOURABLE (9-11 OF 17)				COMBINED	
	05 TEST		06 TEST		05 TEST		06 TEST		TOTALS	
RESIDENCE	#	%	#	%	#	%	#	%	#	%
large city			7	77.8	4	44.4	7	63.6	18	56%
small city			1	11.1	1	11.1			2	6%
town	1	33.3	1	11.1	3	33.3	2	18.2	7	22%
farm	2	66.7			1	11.1	2	18.2	5	16%
reserve									0	0%
INCOME										
under 14,999							1	9.1	1	4%
15 to 24,999	1	33.3			1	11.1	2	18.2	4	14%
25 to 34,999					3	33.3	2	18.2	5	18%
35 to 44,999			4	44.4			3	27.3	7	25%
45 to 54,999			1	11.1	2	22.2			3	11%
over 55			4	44.4	2	22.2	2	9.1	8	29%

are considerably less favourable. There is a problem with these data, however. Four of the 32 students in the negative profile (12.5%) declined to answer the question, while only one positively profiled student declined (4%). Given the small numbers involved, this could considerably alter the results. Indeed, the small size of the sample gives us little confidence in the reliability of the data for either question. Our interviews gave us no additional insights here. If the electronic blackboard impacts more negatively upon low income and rural students it could be of great significance for the project's design model, but our evidence is too equivocal to draw that conclusion.

Academic factors were much less equivocal (see Table 8). Social science majors were much more likely to view the electronic blackboard favourably. "Other" is a residual category which consists mostly of students who have not yet declared a major. These

TABLE 8

STUDENT PROFILE

FREQUENCY DISTRIBUTION BY MAJOR

	VERY FAVOURABLE (12+ OF 17)				FAVOURABLE (9-11 OF 17)				COMBINED	
	05 TEST		06 TEST		05 TEST		06 TEST		TOTALS	
MAJOR	#	%	#	%	#	%	#	%	#	%
Sociology			1	14.3					1	5%
Other Soc, Sci.	2	25	2	28.6					4	18%
Computer Sci.									0	0%
Other Nat. Sci.			1	14.3					1	5%
Pre- Admin	2	25	1	14.3	2	40	1	25	6	27%
Humanities									0	0%
Fine Arts	1	12.5	1	14.3					2	9%
Other	3	37.5	1	14.3	3	60	1	25	8	36%

	VERY UNFAVOURABLE (12+ OF 17)				UNFAVOURABLE (9-11 OF 17)				COMBINED	
	05 TEST		06 TEST		05 TEST		06 TEST		TOTALS	
MAJOR	#	%	#	%	#	%	#	%	#	%
Sociology									0	0%
Other Soc.Sci.	1	33.3	1	11.1			1	9.1	3	9%
Computer Sci.									0	0%
Other Nat. Sci.			1	11.1			1	9.1	2	6%
Pre- Admin	1	33.3	1	11.1	4	44.4	3	27.3	9	28%
Humanities					1	11.1	2	18.2	3	9%
Fine Arts									0	0%
Other	1	33.3	6	66.7	4	44.4	4	36.4	15	47%

students make up nearly half of those in the negative profile. This should not be surprising. The content of the three lectures was very "sociological," and social science majors could be expected to appreciate it more. On the other hand, most of the students in an introductory sociology class at the University of Regina are taking it only to fulfill university requirements. During the interviews several students said they thought the electronic blackboard would have been more appropriate in classes which depend upon equations and formulas, such as economics, mathematics, or engineering. If the electronic blackboard is unable to satisfy introductory students in sociology, it may be more effective in upper level classes or in other disciplines.

The personality of the professor was another uncontrolled factor which seemed to affect the outcome. Many students made reference to some aspect of the professor's personality and style-- Anderson's effective use of personal examples, Knuttila's humour, Stahl's knowledge of the subject. We specifically asked all of the interviewees if they thought that having their regular professor (Knuttila) deliver the presentations would have made a difference. Six of the ten thought it would, only two (both from the night class) unequivocally thought it would not. Many agreed with "Cindy:" "I am not used to his [Stahl's] teaching methods, so it is hard for me to make a good comparison or good evaluation of what I think." Teaching is a dynamic process. It is quite clear that content, method, format, and style are all a part of that process. Students become used to a particular style and personality, they have expectations about what will happen in class. A guest lecturer brings an element of novelty. Some look forward to it, as "Al" did: "I thought with a different prof you are looking for something different. You are looking forward to seeing him so you will be paying a little bit more attention because it is a different kind of style." But novelty can soon wear thin, and differences in style and format (particularly a very different format such as the electronic blackboard) can cause problems for some. As "Alice" put it: "It took the full three days to really get used to it."

We cannot quantify the extent of the human factor in the experiment, but the students insist it is integral to the process of teaching.

Finally is the factor of student expectations. A number of student comments expressed disappointment in what they saw. "Elsie" spoke for these when she said:

> If this computerized technology is going to be used for individual instruction I think a lot more has got to be done. Just programming and graphics and headlines and major points aren't necessarily the way to go; you can do that on an overhead screen, you can do that on xeroxed pieces of paper. I think I was expecting a lot more. I don't know why and I'm really not sure what I was looking for in the class itself. I just thought that the computerized section was sadly lacking something.

Most students are familiar with the excitement of video games and the special effects of Lucas and Disney. They have all seen the advertising hype surrounding computers which so oversells their abilities. So while for us the point of departure for the electronic blackboard was the traditional chalkboard and overhead, many students may have expected Star Wars and Nintendo. What they got could not help but be disappointing by comparison. As with other human factors, their disappointment cannot be quantified but it certainly played some role in their response.

CONCLUSIONS

The electronic blackboard was not successful in our experiment. We measured negative impacts on all of our variables. Faculty productivity declined sharply. We had expected lengthy preparation time, but not of the magnitude which we encountered. It took five times as long to prepare an illustrated lecture as a normal one for a moderately experienced user whose research was complete and who had all materials at hand. In spite of this, teaching quality declined, in the estimation of both the lecturer and the faculty review panel, as the electronic presentation interfered with normal patterns of classroom interaction. The students were dissatisfied with the electronic blackboard. We deliberately chose unpopular material for the experiment, as is reflected in sharply negative responses in the control class. The electronic blackboard did nothing to improve this. The

evaluations of both test classes were not significantly different from the control group but were much worse than the pre-experiment classes.

The most successful aspect of the electronic blackboard was the organization of the presentation. The illustrated lectures were less boring than the same material presented without illustrations, but much more boring than the pre-experiment lectures. Contrary to expectations, the illustrations did not help students understand or remember the material better, nor to take notes better. There were several reasons for this. Many students found the presentation hard to see. More importantly, the electronic blackboard forced students to concentrate on two different sources of information simultaneously. The resulting division of attention and distraction more than negated whatever benefits might have been gained by superior organization and visual imagery.

A number of uncontrolled factors influenced the outcome. These included the layout and lighting of the classrooms, the personality and style of the professors, and student expectations. Social science majors were more favourably inclined to the presentations, while those who had not declared a major were much less so. Gender was apparently not a major factor, but there is some (albeit not very reliable) evidence that rural and low income students were negatively affected by the electronic blackboard.

Given the current state of the technology, the electronic blackboard is not effective under the conditions tested. It remains possible that in smaller, upper level classes or in more technically-oriented disciplines it may still prove useful.

If the electronic blackboard is to have a place in the lecture hall, we believe that three obstacles will have to be overcome. The first is in display technology. Until affordable, high-quality display technology is readily available, the electronic blackboard is not suitable for large classes. The computer industry has done well in getting high-resolution colour graphics to the computer's monitor screen. The problem is in displaying those images to a large group. This is crucial. If students cannot see the presentation clearly, the electronic blackboard is worse than a waste of time and resources. Should a

university wish to pursue the electronic blackboard as a teaching device, considerable attention must be paid to acquiring and deploying suitable display technology. Unless that technology is easily mobile and effective under a variety of lighting conditions, dedicated classrooms will have to be constructed. Unless conversion from monitor to large screen is simple, technical assistance will have to be provided. Computers and software are only the initial expense.

The second obstacle is preparation time. The time involved in producing illustrated lectures is prohibitive. Better, easier-to-use software and a wider selection of appropriate electronic clip art would be of some help, but to a large measure this problem is inherent in the electronic blackboard. Should a university wish to develop the electronic blackboard, it will have to seriously consider giving faculty release-time from normal duties for preparation. Once developed, of course, it should not be as time consuming to revise an illustrated lecture, but we suspect revision time will be considerable as well.

The third obstacle is the divided attention and distraction which the electronic blackboard produced in the classroom. Most of the interviewees and many written comments dwelt on the importance of the interaction between professor and student and the rapport which grows from it. The key to quality teaching is in these human factors. To be successful, any electronic aid would have to enhance these factors. Our experience with the electronic blackboard was that it seriously interfered with them. This is an obstacle which, frankly, we do not see as amenable to technical improvement. Indeed, it raises questions which the evaluation of all forms of electronic teaching need to address. Unless this obstacle can be overcome, there is not much point in pursuing the electronic blackboard.

These three obstacles are serious impediments. Some forms of computerized teaching may be effective in the university classroom, but we believe that at this time the electronic blackboard is not one of them. We do not recommend its incorporation into the design model.

REFERENCES

Danzinger, James N. (1985). Social Science and the Social Impacts of Computer Technology. *Social Science Quarterly* Vol. 66, No. 1, March

Jolicoeur, Karen and Berger, Dale. (1986). Do We Really Know What Makes Software Effective? A Call for Empirical Research on Effectiveness. *Educational Technology*. December

Lieberson, Stanley. (1985). *Making It Count: The Improvement of Social Research and Theory*. Berkeley: University of California Press

McLuhan, Marshall. (1964). *Understanding Media: The Extensions of Man*. New York: McGraw-Hill

Meyrowitz, Joshua. (1985). *No Sense of Place: The Impact of Electronic Media on Social Behavior*. New York: Oxford University Press

APPENDIX A

CONSENT FORM

ELECTRONIC BLACKBOARD EXPERIMENTS

CONSENT FORM

This class will involve electronic blackboard experiments conducted by Drs. Chandler, Knutilla, Maguire, and Stahl. These experiments are part of a project to develop a design model for a computerizing university, funded by the Canadian International Development Agency and the government of India. The purpose of these experiments is to discover whether or not microcomputer-based presentational technology (electronic blackboards) improves faculty productivity, the quality of teaching, and the quality of learning.

I understand that several times during the class the professor or a guest lecturer will make presentations of class material using computer technology and that I will be asked to evaluate these presentations. I understand that as part of the experiment I will be asked to evaluate non-computer portions of the class as well. These evaluations will involve me in filling out questionnaires and being interviewed.

I consent to participating in these evaluations. I understand that questionnaires will be anonymous and that interviews will be kept confidential. I also understand that I am free not to participate if I so choose and that my marks for this class will not be affected, either way, by my choice.

_____ _____

name (please print) signature

_____ _____

student number date

APPENDIX B

B.1 PRE-EXPERIMENT AND CONTROL QUESTIONNAIRE

B.2 TEST QUESTIONNAIRE

B.1

ELECTRONIC BLACKBOARD EXPERIMENTS

EVALUATION QUESTIONNAIRE

DO NOT SIGN YOUR NAME OR STUDENT NUMBER TO THIS FORM.

CLASS NAME AND NUMBER: _____.

Please circle the appropriate number.

1. In what year were you born? 19 __ __

2. Sex
   - female.....1
   - male.....2

3. Faculty or Program
   - Administration.....01
   - Arts (incl. Campion & Luther)...02
   - Education.....03
   - Engineering.....04
   - Grad. Studies and Research.....05
   - Physical Activity Studies.....06
   - Sask. Indian Fed. College.....07
   - Science (incl. Camp.& Luther)...08
   - Social Work/Human Justice.....09
   - University Entrance Program.....10
   - Other.....11

4. Major
   - Sociology.....01
   - Other Social Science.....02
   - Computer Science.....03
   - Other Natural Science.....04
   - Pre-Administration.....05
   - Humanities.....06
   - Fine Arts.....07
   - Other.....08

5. How many classes have you taken before this semester?
   - 0.....1
   - 1-2.....2
   - 3-4.....3
   - 5-8.....4
   - more than 8.....5

6. What is your cumulative grade point average?
   - less than 59%.....1
   - 60-69%.....2
   - 70-79%.....3
   - 80-89%.....4
   - 90% or better.....5

7. Is English your first language?

yes.....1
no.....2

8. Where is your family from?

large city (Regina, etc.).....1
small city (Moose Jaw, etc).....2
town.....3
farm.....4
reserve.....5

9. What is your family's annual income?

under $14,999.....1
$15,000 - $24,999.....2
$25,000 - $34,999.....3
$35,000 - $44,999.....4
$45,000 - $54,999.....5
$55,000 or more.....6

Please rate the class presentation by circling the number that represents the response closest to your opinion:

1=poor 2=fair 3=average 4=good 5=excellent

10. The organization of this presentation was: 1 2 3 4 5

11. Compared with other portions of this class, this presentation was: 1 2 3 4 5

12. The effectiveness of the presentation was: 1 2 3 4 5

13. The appropriateness of the presentation's format for the subject matter was: 1 2 3 4 5

14. Compared to other classes I have taken, this presentation was: 1 2 3 4 5

15. The pace at which the presentation covered the material was: 1 2 3 4 5
If you answered 1(poor) or 2(fair), was the presentation: too slow....1
too fast....2

16. I would rate the overall quality of the presentation as: 1 2 3 4 5

17. Apart from the material presented, I would rate the instructor for this presentation as: 1 2 3 4 5

Please rate the following statements by circling the number that represents the response closest to your opinion:

1=strongly disagree 2=disagree 3=undecided
4=agree 5=strongly agree

18. The presentation was boring:	1	2	3	4	5
19. The presentation was hard to see:	1	2	3	4	5
20. The presentation helped me take notes better:	1	2	3	4	5
21. This material is too difficult:	1	2	3	4	5
22. During the presentation I am afraid to interrupt with a question:	1	2	3	4	5
23. The presentation helped me to better understand the material:	1	2	3	4	5
24. The presentation helped me to better remember the material:	1	2	3	4	5
25. I would like to see more of this kind of presentation:	1	2	3	4	5

ADDITIONAL COMMENTS

A. Which aspects of the instructor's presentation did you appreciate most, and <u>why</u>?

B. Are there areas in which the instructor's presentation could be improved, and <u>how</u>?

C. Are there any other areas about which you would like to comment?

B.2

ELECTRONIC BLACKBOARD EXPERIMENTS

EVALUATION QUESTIONNAIRE

DO NOT SIGN YOUR NAME OR STUDENT NUMBER TO THIS FORM.

CLASS NAME AND NUMBER: _____.

Please circle the appropriate number.

1. In what year were you born? 19 __ __

2. Sex
   - female....1
   - male....2

3. Faculty or Program
   - Administration....01
   - Arts (incl. Campion & Luther)...02
   - Education....03
   - Engineering....04
   - Grad. Studies and Research....05
   - Physical Activity Studies....06
   - Sask. Indian Fed. College....07
   - Science (incl. Camp.& Luther)...08
   - Social Work/Human Justice....09
   - University Entrance Program....10
   - Other....11

4. Major
   - Sociology....01
   - Other Social Science....02
   - Computer Science....03
   - Other Natural Science....04
   - Pre-Administration....05
   - Humanities....06
   - Fine Arts....07
   - Other....08

5. How many classes have you taken before this semester?
   - 0....1
   - 1-2....2
   - 3-4....3
   - 5-8....4
   - more than 8....5

6. What is your cumulative grade point average?
   - less than 59%....1
   - 60-69%....2
   - 70-79%....3
   - 80-89%....4
   - 90% or better....5

7. Is English your first language?

yes.....1
no.....2

8. Where is your family from?

large city (Regina, etc.).....1
small city (Moose Jaw, etc).....2
town.....3
farm.....4
reserve.....5

9. What is your family's annual income?

under $14,999.....1
$15,000 - $24,999.....2
$25,000 - $34,999.....3
$35,000 - $44,999.....4
$45,000 - $54,999.....5
$55,000 or more.....6

Please rate the class presentation by circling the number that represents the response closest to your opinion:

1=poor 2=fair 3=average 4=good 5=excellent

10. The organization of this presentation was: 1 2 3 4 5

11. Compared with other portions of this class, this presentation was: 1 2 3 4 5

12. The effectiveness of the presentation was: 1 2 3 4 5

13. The appropriateness of the presentation's format for the subject matter was: 1 2 3 4 5

14. Compared to other classes I have taken, this presentation was: 1 2 3 4 5

15. The pace at which the presentation covered the material was: 1 2 3 4 5

If you answered 1(poor) or 2(fair), was the presentation:

too slow....1
too fast....2

16. I would rate the overall quality of the presentation as: 1 2 3 4 5

17. Apart from the material presented, I would rate the instructor for this presentation as: 1 2 3 4 5

Please rate the following statements by circling the number that represents the response closest to your opinion:

1=strongly disagree 2=disagree 3=undecided
4=agree 5=strongly agree

18. The presentation was boring:	1	2	3	4	5
19. The presentation was hard to see:	1	2	3	4	5
20. The presentation helped me take notes better:	1	2	3	4	5
21. This material is too difficult:	1	2	3	4	5
22. During the computerized presentation I am afraid to interrupt with a question:	1	2	3	4	5
23. The computerized presentation helped me to better understand the material:	1	2	3	4	5
24. The computerized presentation helped me to better remember the material:	1	2	3	4	5
25. I would like to see more of this kind of presentation:	1	2	3	4	5
26. I find the computerized presentation distracting:	1	2	3	4	5

ADDITIONAL COMMENTS

A. Which aspects of the instructor's presentation did you appreciate most, and <u>why</u>?

B. Are there areas in which the instructor's presentation could be improved, and <u>how</u>?

C. Are there any other areas about which you would like to comment?